



# Update on HF PMT response

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# Overview

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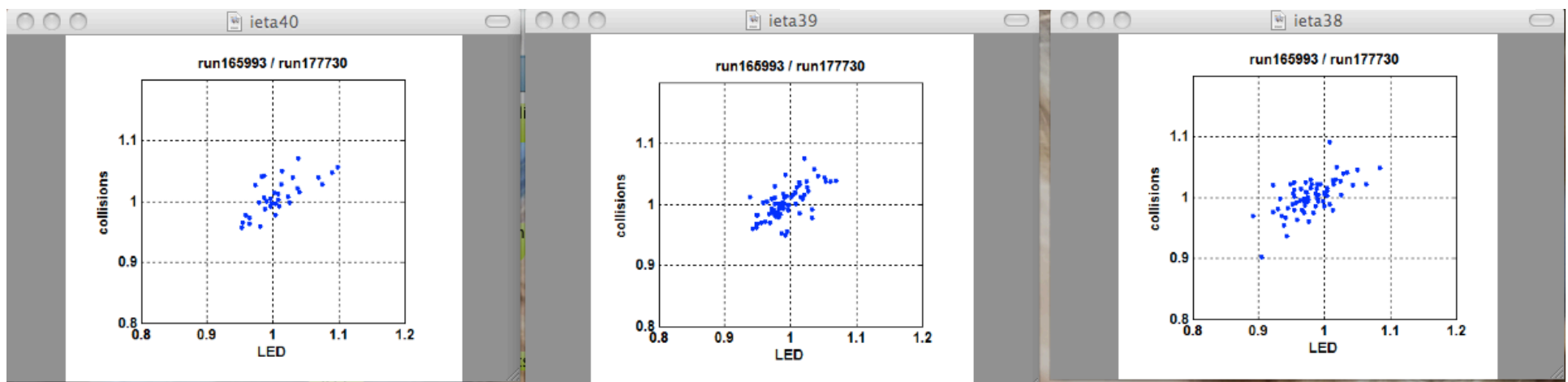
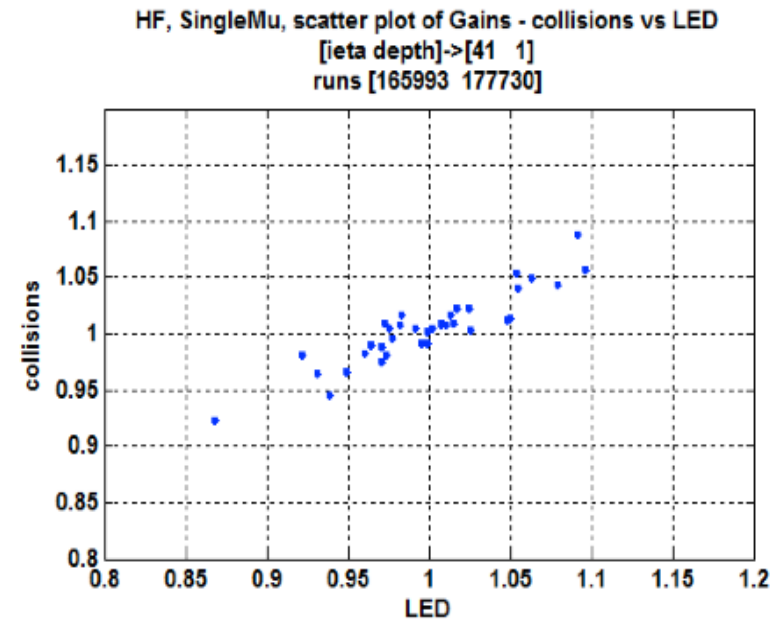
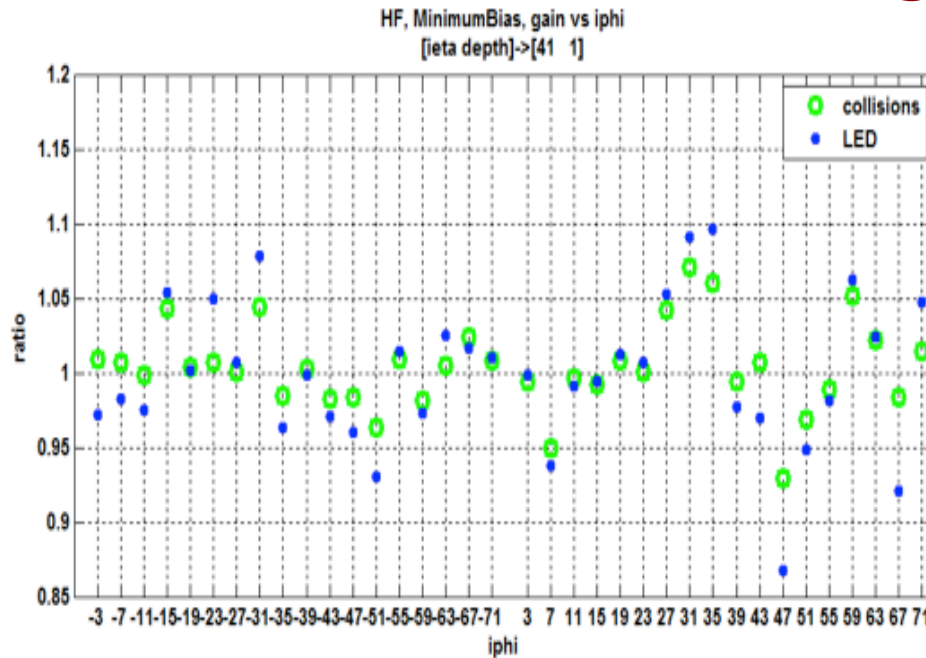
- Available data
  1. HF LED data (local runs)
  2. Laser data (abort-gap, global runs, only HFM)
  3. Phi-symmetry of collisions data (also work in parallel by brian dorney)
  4. SPE analysis (joe pastika)
  5. After-pulse data (sercan sen, work in progress)
  6. LED trend plots during magnet ramp-down of CMS magnet
  7. LED trend plots since end of pp collisions
- Preparing IOVs for HF LEDcorrections
- Outlook for updating conditions in 2012
  - Gain corrections
  - LUTs

# Present understanding

- LED& Laser data implies that effect can NOT be explained by radiation damage of HF quartz fibers
- Phi-symmetry analysis of collisions data confirms the effect =>
  - rules out hypothesis that effect is only some sort of damage of calibration system
- Eta and depth-dependence favor hypothesis of physical change in PMTs
- We do NOT observe increase in after-pulse rate (2011 vs 2009)
- We conclude that we observe actual loss of PMT gain
- SPE indicate degradation of dynode gain
  - No indication of degradation of quantum efficiency of photocathode
- LED data during magnet-ramp down: large drifts for some of the channels
- After-pulse data: work in progress

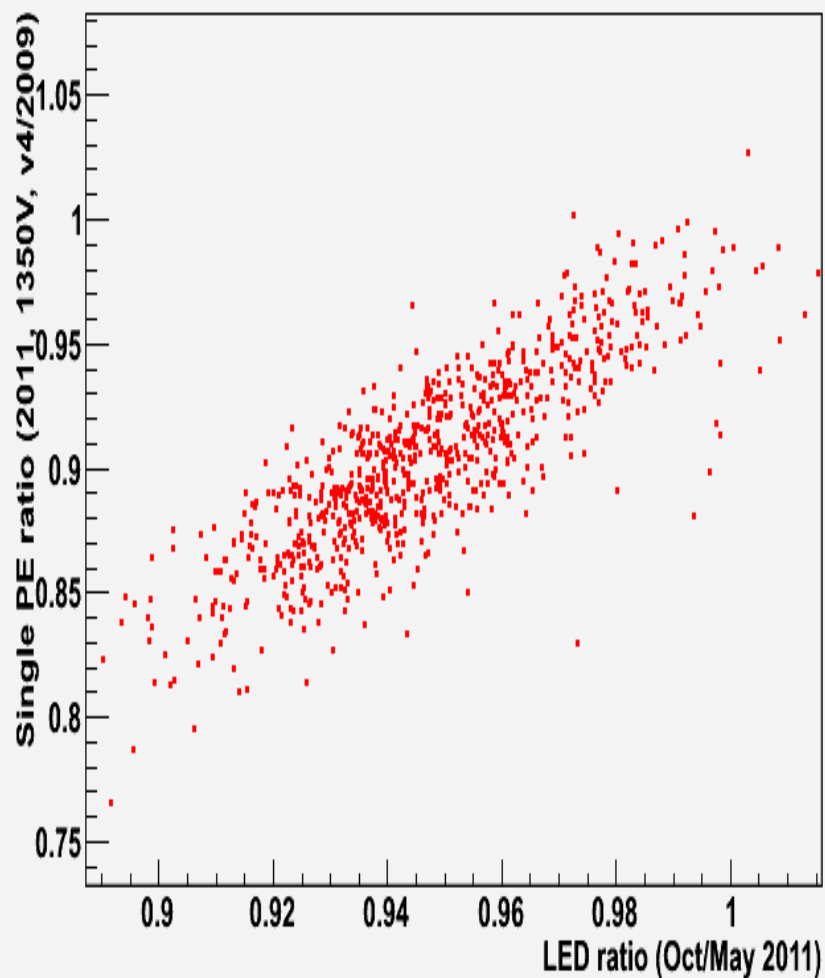
# Phi-symmetry using collisions

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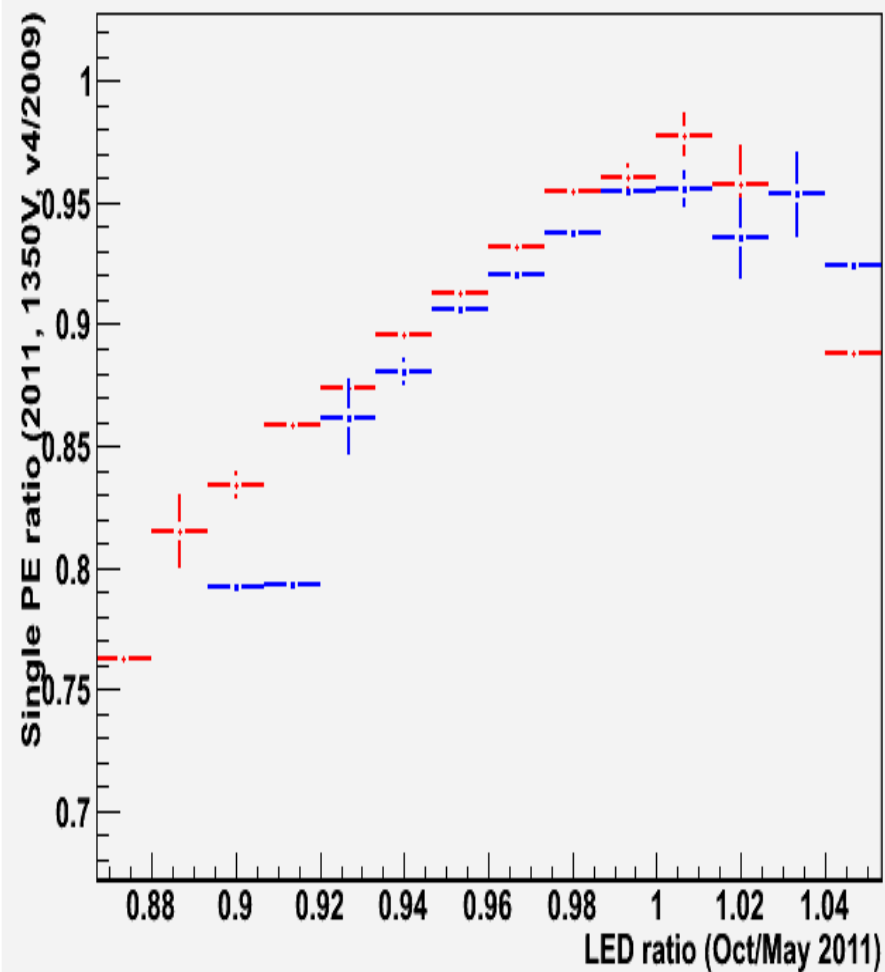


# Single Photo-electron data (1)

HF Depth=1: Single PE ratio ve LED ratio



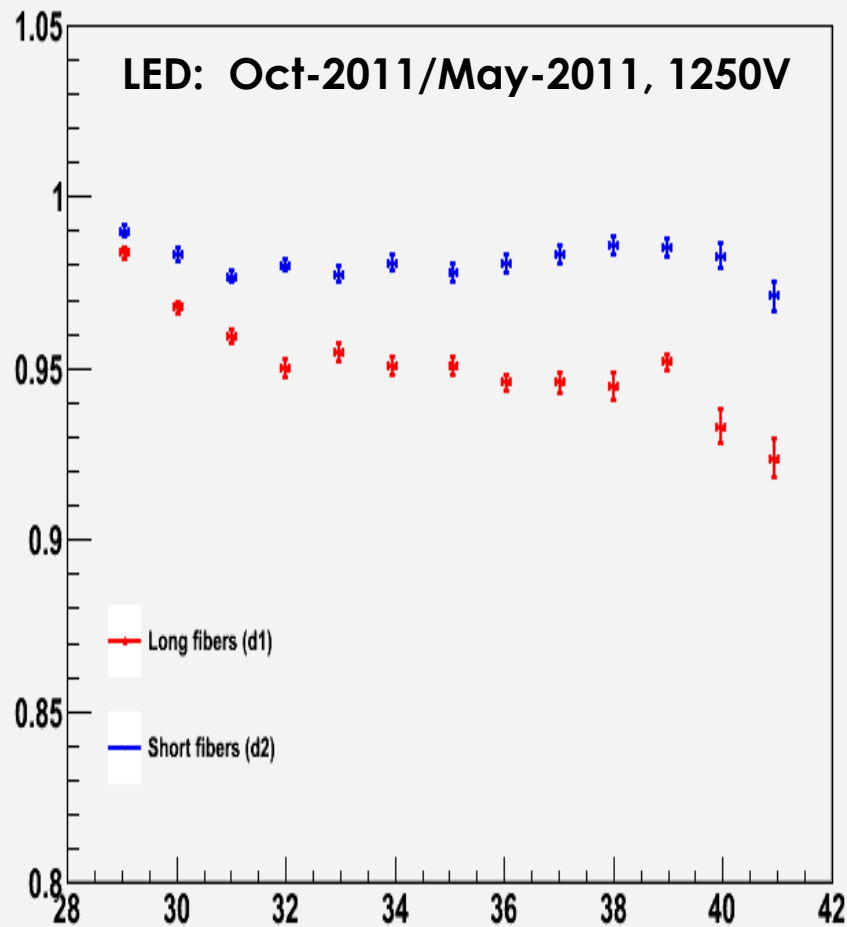
HF SPE vs LED: red - depth1, blue - depth2



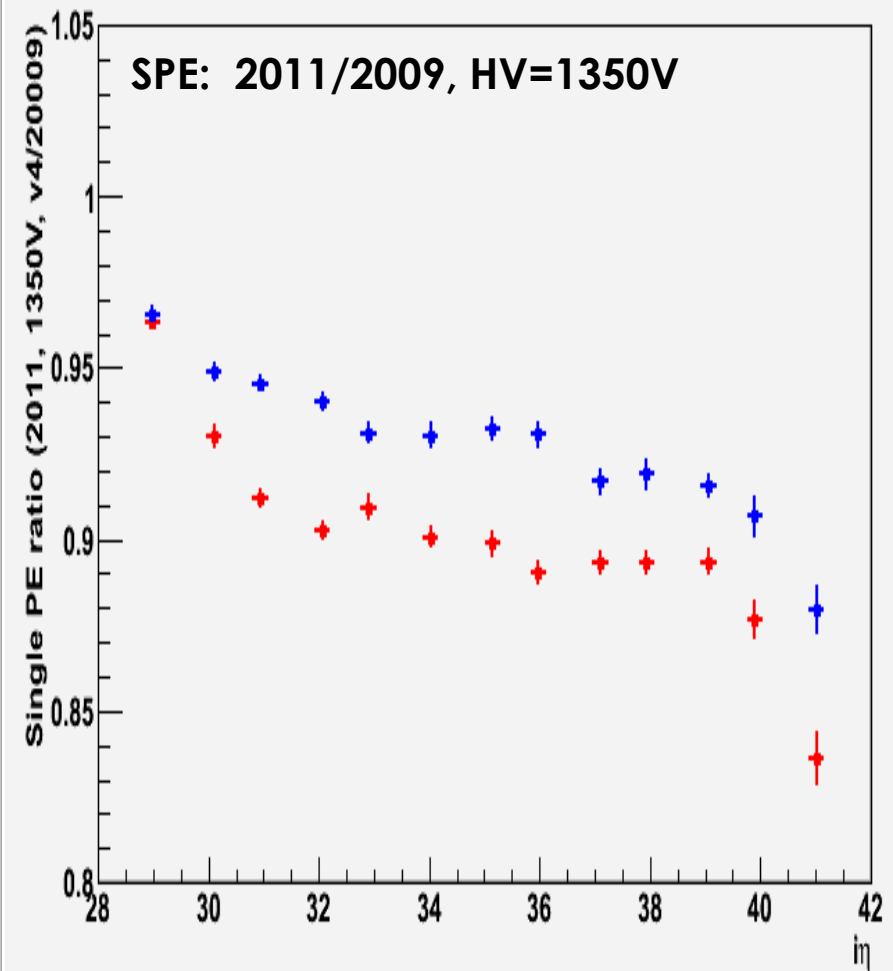
# LED and Single Photo-electron data

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HF depth=1: LED ratio(Oct/May) vs  $\ln$



HF SPE ratio vs  $\ln$  (red - depth1, blue - depth2)



# After-pulse data

- Data taken last week
- Analysis on-going...
- See more details in Sercan's HCAL Ops mtg talk

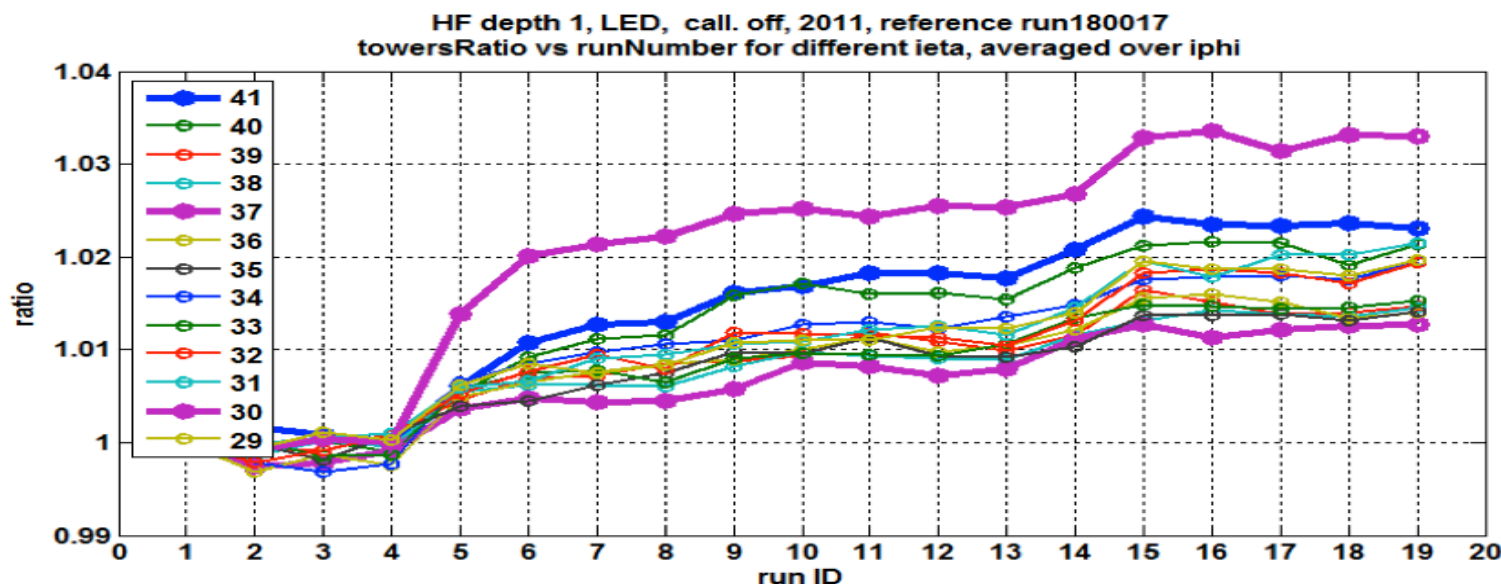
# Behavior during magnet ramp-down

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HF, magnet on/off, 2011-11-07

LED runs:

run#	180017	180168	180187	180397	180406	180411	180417	180422	180436	180460
run ID	1	2	3	4	5	6	7	8	9	10
B, T	3.8	3.8	3.8	3.8	3.6	3.4	3.2	3.0	2.0	2.0
run#	180461	180473	180479	180484	180545	180556	180616	180630	180723	
run ID	11	12	13	14	15	16	17	18	19	
B, T	1.0	~0.062	0	0	0	0	0	0	0	





# Trend plots after end of pp run

- Plots not available at this time...

# summary

- HF response
  - Collisions data confirms initial observations of LED and Laser
    - phi dependence of PMT response loss is common in calibration and collisions data
    - Eta dependence can not be confirmed, as phi-symmetry method normalizes out any eta-dependent response changes
    - In particular, the neither Phi-symmetry analysis nor LED&Laser analysis is sensitive to potential radiation damage of quartz fibers (assuming RadDam is phi-symmetric)
  - SPE analysis shows strong correlation with LED&Laser data and implies reduction of dynode gains as source of response loss in HF PMTs
  - Observed drifts in some PMT response during magnet ramp-down, under further study
- LEDcorr for HF
  - IOV corrections effort almost finished
  - Validation under way, expect to provide new Tag on Nov 15th